

day. The negroes use them to wattle the walls of their huts, and call the bush "Alligator Tree," probably from the two Spanish words "*a ligar*," to tie with. Where it stands free, it attains the size of a full-grown apple-tree; but it invariably, I believe, grows within shelter of some other and larger one.

Except this genus and *Trichilia*, I found no other in Jamaica that had the character of leaf above described.

The President exhibited numerous specimens of recent and fossil *Cycadææ*. Among these was a fine specimen of a new species (*Cycadites Saxbyanus*, R. Br.) found in the Isle of Wight by Mr. Saxby of Bonchurch. The President remarked that all the specimens of *Cycadites* hitherto found in the Isle of Wight agreed in having an elliptical outline, unaccompanied with any inequality in the woody ellipsis, and also in having a bud in the axilla of each leaf; in these respects differing from the *Cycadites* of the Isle of Portland and from all the recent species of *Cycadææ* with which we are acquainted, which have a circular outline and only scattered buds.

#### ROYAL SOCIETY.

March 4, 1852.—A paper was read, entitled, "On the Anatomy of *Doris*." By Albany Hancock, Esq., and Dennis Embleton, M.D., Lecturer on Anatomy and Physiology in the Newcastle-on-Tyne College of Medicine, in connection with the University of Durham. Communicated by Professor E. Forbes, F.R.S.

The authors have proposed to themselves to describe the anatomy of the three genera typical of the three groups of the Nudibranchiate Mollusca. An account of the structure of *Eolis* has already appeared in the 'Annals of Natural History.'

A detailed description is given of the anatomy of *Doris*, the following species of which have been examined, and are referred to in the paper: *D. tuberculata*, Auct., *D. tuberculata*, Verany, *D. Johnstoni*, *D. tomentosa*, *D. repanda*, *D. coccinea*, *D. verrucosa*, *D. pilosa*, *D. bilamellata*, *D. aspera*, and *D. depressa*; but *D. tuberculata* of English authors has been taken as the type of the genus, and the standard of comparison for the rest.

*Digestive System*.—The mouth in all the species is a powerful muscular organ, provided with a prehensile tongue beset with siliceous spines, which when the tongue is fully developed, are arranged in a median and two lateral series. Certain species possess, besides, a prehensile spinous collar on the buccal lip, occasionally associated with a rudimentary horny jaw. The mode of development of the lingual spines is shown to be the same as that of the teeth of the Vertebrata.

The *œsophagus* varies in length; in some it is dilated at the top, forming a crop; in others it is simply enlarged previously to entering the liver mass. The *stomach* is of two forms; one, as in *D. tuberculata*, is very large, receiving the *œsophagus* behind, and giving off the intestine in front, and lying in advance of the liver; the other is

received within the mass of the liver, and is very small. *The liver* in all is bulky, mostly bilobed, and variously coloured, and pours its secretion by one or more very wide ducts into the cardiac end of the stomach. A small laminated pouch—a rudimentary *pancreas*, is attached in some species to the cardiac, in others to the pyloric end of the stomach. *The intestine* is short, of nearly the same calibre throughout, rather sinuous in its course, and terminates in a nipple-formed anus in the centre of the branchial circle.

*The Reproductive Organs* are male, female and hermaphrodite. *The male organs* consist of penis and testis; the latter is connected with the former and with the oviduct. *The female organs* are, ovarium, oviduct, and mucus-gland. The ovarium is spread over the surface of the liver in the form of a branched duct with terminal ampullæ. The oviduct terminates in the mucus-gland. *The androgynous apparatus* is a tube or vagina opening from the exterior into the oviduct, having one or two diverticular spermathecæ communicating with it in its course. On the right margin of the body near the front is a common opening, to which converge the three parts of the reproductive organs. The spermatozoa are developed within large and fusiform spermatophora, and are observed in the spermathecæ, oviduct and ovary.

*Organs of Circulation and Respiration.*—The circulatory organs are, a systemic heart, arteries, lacunæ and veins. The existence of true capillaries in the liver-mass seems probable. A second heart—a ventricle, having a portal character, is also described. The systemic heart lies immediately beneath the dorsal skin, in front of the respiratory crown, and comprises an auricle and ventricle enclosed within a pericardium. In the systemic circle the blood is returned to the heart without having passed through the special respiratory organ. It is that blood only which is returned from the liver-mass that circulates through the branchiæ.

The authors conclude from their observations, that in the Mollusks there is a triple circulation: first, the systemic, in which the blood propelled along the arteries to the viscera and foot is returned, with the exception of that from the liver-mass, to the heart through the skin; there it becomes partially aërated, the skin being provided with vibratile cilia, and otherwise adapted as an instrument of respiration; second, the portal, in which venous blood from the system is driven by a special heart to the renal and hepatic organs, and probably to the ovarium, where it escapes, doubly venous, with the rest of the blood which has been supplied to these organs from the aorta, and which is therefore only singly venous, to the branchiæ; third, the branchial circulation, in which flows only the more deteriorated blood brought by the hepatic vein, but in which also that blood undergoes the highest degree of purification capable of being effected in the economy, namely in the special organ of respiration. This triple circulation has not yet, as far as the authors are aware, been described as existing in the Molluscan Subkingdom. From the fact of the blood in *Doris* being returned to the heart in a state of partial aëration, it is clear, they say, that this animal is, in this

respect, on a par with the higher Crustaceans; and from the blood arriving at the heart in the same condition, according to the researches of Garner and Milne-Edwards, in *Ostrea* and *Pinna*, the great *Triton* of the Mediterranean, *Haliotis*, *Patella* and *Helix*, it can scarcely be doubted that this arrangement will be found throughout the Mollusca.

From a consideration of the facts cited in the paper, it may be deduced that the skin or mantle is in the Mollusca the fundamental organ of respiration, and that a portion of that envelope becomes evolved into a speciality as we trace upwards the development of the respiratory powers.

Upon the dorsal aspect of the liver-mass is a branched cavity, that of the *renal organ*, lined with a spongy tissue, and opening externally at the small orifice near the anus.

*Organs of Innervation.*—These are in two divisions, one corresponding to the cerebro-spinal division, the other to the sympathetic or ganglionic system of the Vertebrata. The existence of the latter, it is stated, is now for the first time fully established. The centres of the first system are seven pairs and a half of ganglia. Of the seven pairs, five are supra-œsophageal, two, infra-œsophageal: the single ganglion belongs to the right side and has been named *visceral*. There are three nervous collars around the œsophagus, one of which connects the infra- with the supra-œsophageal. The total number of pairs of nerves from the œsophageal centres is twenty-one, and there are also four single nerves.

The sympathetic system exists, and is more or less demonstrable, in the skin, the buccal mass, and on all the internal organs. It consists of a vast number of minute distinct ganglia, varying in size and form, the largest quite visible to the naked eye, of a bright orange colour, like the ganglia around the œsophagus, and interconnected by numerous delicate, white nervous filaments, arranged in more or less open plexuses. This beautiful system is connected with both sets of œsophageal ganglia.

The authors having found the sympathetic nervous system in several species of *Doris*, in *Eolis papillosa*, and in *Arion ater*, believe it to exist in all the more highly organized Mollusca.

The supra-œsophageal nervous centres in the Mollusca are in some instances so concentrated as to have led to the idea that they form only one mass; in others the ganglia are more or less distinct, and separated from each other. *Doris* has been taken as the representative of one class, *Aplysia* of the other, and on a comparison of both the supra- and infra-œsophageal ganglia of these with each other, there has been found a close correspondence between them, with the exception of the visceral ganglion. The single one in *Doris* is represented in *Aplysia* by a pair of ganglia, situated in the posterior part of the body near the root of the branchiæ. The supra-œsophageal ganglia in the Lamellibranchiata appear homologous with those of *Doris*.

Having determined the existence of a true sympathetic or organic nervous system in *Doris*, the authors feel themselves more in a position to trace a parallelism between the œsophageal nervous

centres of these Mollusca and the cerebro-spinal system of the Vertebrata, and accordingly they find there is a strict analogy between them, even to the individual pairs of ganglia of which they respectively consist, the general result being that the whole of the ganglia, grouped around the œsophagus in these Mollusca, answers to the encephalon, and a small portion of the enrachidion, of the Vertebrata.

*Organs of the Senses.*—The auditory capsules are microscopic, composed of two concentric vesicles, the inner enclosing numerous, oval, nucleated otolithes. The eyes are minute black dots, beneath the skin, attached by a pedicle to a small ganglion. They are made up of a cup of pigment, receiving from behind the nerve, and lodging in front a lens, having in advance of it a cornea, the whole enclosed by a fine capsule. The authors believe they have shown the dorsal tentacles to be the olfactory organs.

The organs of touch are, the general surface of the skin, but more particularly the oral tentacles or veil. Taste is most probably located in the lips and channel of the mouth, the tongue being a prehensile organ, and ill-adapted as the seat of such a function.

In conclusion, the authors comment on the high organization of the *Doridae*, and express their belief that the genus, as at present understood, will require to be broken up into several groups.

#### BOTANICAL SOCIETY OF EDINBURGH.

July 8, 1852.—Dr. Sellar, President, in the Chair.

The following papers were read:—

1. "On the presence of Fluorine in the stems of Gramineæ, Equisetaceæ, and other Plants, with some observations on the sources from which vegetables derive this element," by George Wilson, M.D.

The author commenced by stating, that the earliest observer of the presence of fluorine in plants was Will of Giessen, who found traces of it in barley, the straw and grain of which were analysed together. The author reported to the Botanical Society, some four years ago, the results of his earlier researches into the distribution of this element throughout the vegetable kingdom, which were not very numerous or very encouraging. One reason of this was the small extent to which fluorine occurs in plants; another, and practically as serious a reason, was the difficulty of separating and recognising fluorine when accompanied by silica. The presence of this body in a plant, besides greatly complicating the investigation, rendered the employment of platina vessels essential, and thus limited the amount of material which could be subjected to examination, besides making it difficult or impossible to observe the progress of an analysis.

The author then stated, that, in the course of some recent investigations into the presence of fluorine in siliceous rocks, he had succeeded in devising a process which was also applicable to plants, and could be carried on in the ordinary glass vessels of the laboratory. The process in the case of plants was as follows:—The plant under examination was burned to ashes as completely as possible. The